Real Time and Secure Video Transmission using Open MPI and Open MP

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Abstract*: Digital transmission is increasing day by day. In multimedia technology transmitting digital data must be secure, private and fast. This paper introduces efficient and secure real time transmission by using parallel and distributed approach for fast transmission of data which is used in conferences, video on demand etc. This papers aims to make video encryption feasible for real time application without using any extra dedicated at receiver side. The paper also introduces some new technique which is Open MPI and Open MP.*

Keywords*:* Open MPI, Open MP, TAPI protocol, AES encryption, HEX string.

1. Introduction

Advances in digital content transmission have increased now days. In multimedia technology the important issues are security and privacy. The given project proposes an efficient and fast video transmission technique and secure video encryption algorithm. The project aims to make real time video transmission using parallel and distributed approach. Video conferencing is most popular application of video transmission. For better conferencing, transmission must be fast and secure. Video conferencing is used as a communication tool to communicate with several individuals or groups in real time across different locations e.g. conducting a conference between two or more clients at different sites by using computer networks to transmit audio and video data. Each client will have a video camera, speakers, and microphone inbuilt on their computer. Video images are continuously transferred to other person's computer at a very fast rate by web camera such that the other person sees the continuous picture. The project aims to send video and audio to client parallely without keeping any client idle. The paper introduces new technique which transmits video with high quality, securely and with fast speed. The techniques are Open MPI and Open MP. The details of Open MPI and Open MP are discussed below for parallel processing and video encryption technologies for securing the video.

Figure 1: Architecture of real time video transmission

2. Methodology

Before we move on to Open MPI and Open MP, let's discuss Parallel Processing with one example. If there are two or more processors are built in the computer, we can use both the processors for execution of the algorithm in parallel processing mode. This will speed up the processing. If parallel processing is not used, only one processor will function to execute the algorithm and other will sit idle. Hence, parallel processing can speed up the processing of algorithm.

The new methods of parallel processing are as below:

1. MPI (Message Passing Interface)

MPI is a standardized API (Application Program Interface) used for parallel and/or distributed computing. Open MPI has widely used library back up which is developed and maintained by resources from computing community, technologies and expertise's. Open MPI provides advantages for application developers and researchers in the field of computer science.

Features of Open MPI include:

- Thread safety
- Dynamic process spawning
- Network and process fault tolerance
- Run-time instrumentation
- High performance on all platforms
- Portable
- Maintainable

2. Open MP

Open MP is an implementation of multithreading, a method of parallelizing whereby a master *thread* (a series of instructions executed consecutively) *forks* a specified number of slave *threads* and a task is divided in between them. The threads then run concurrently, with the runtime environment allocating threads to different processors.

Understanding the Fork-and-Join Model:

Open MP is based on the use of Fork and join parallelism model. Operation is executed by creating and branching out from a master thread to create parallel threads which will be used to execute an operation. Once operation is finished, all the threads are destroyed and only master thread will remain. The process of splitting and joining of

threads including synchronization for end result is handled by Open MP.

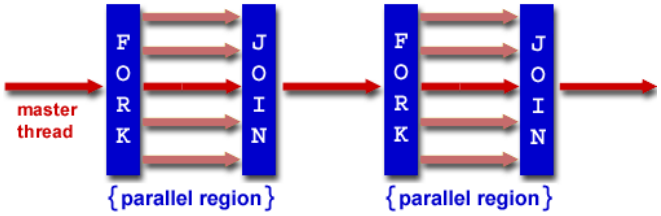

Figure 2: Fork- and-join Model

TAPI (Telephony Application Programming Interface)

It is protocol used to transfer audio and video signals. As telephony and call control become more common in the desktop computer, a general telephony interface is needed to enable applications to access all the telephony options available on any computer. The media or data on a call must also be available to applications in a standard manner. IP telephony is poised for explosive growth, as organizations begin a historic shift from expensive and inflexible circuit-switched public telephone networks to intelligent, flexible, and inexpensive IP networks. Microsoft, in anticipation of this trend, has created a robust computer telephony infrastructure, TAPI. Now in its third major version, TAPI is suitable for quick and easy development of IP telephony applications.

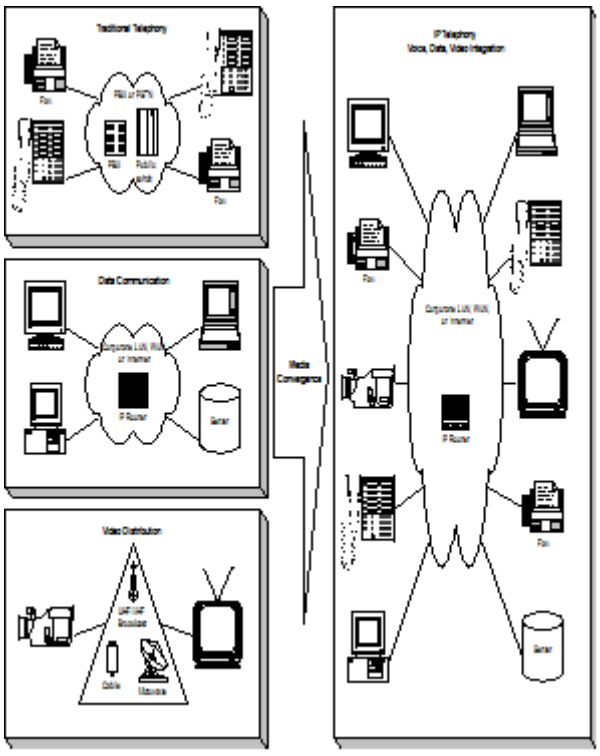

Figure 3: Architecture of TAPI protocol

Video Encryption

The encryption and decryption of video stream can be done in two ways:

1. Public key cryptography
2. Private Key cryptograph

Public key cryptography is not applicable for real time video conferencing because its operation requires significant amount of time which is not suitable for video conferencing [3].

There are various private key encryption algorithms as below:

1. Naïve algorithm: It encrypts each and every byte of whole video stream which provides more security level but it is not a workable solution if size of data is large.
2. Selective algorithm: In this, video is divided into 3 frames I P and B. The algorithm encrypts all headers and I (initial) frames initially followed by encrypting all I frames and all I blocks in P and B frames, and finally encrypts all frames as in Naive algorithm.
3. ZIG-ZAG algorithm: It encrypts the algorithm before compressing them. It uses random permutation if the permutation list is known; the algorithm will not be secure.
4. AES (Advance Encryption Standers) algorithm: The AES algorithm is symmetric key cryptosystem that processes 128-bit data blocks using cipher keys with lengths of 128, 192, or 256 bits. It is more scalable and can handle different key sizes and data block sizes, however they are not included in the standard. The basic blocks of AES operation are shown in figure [5].

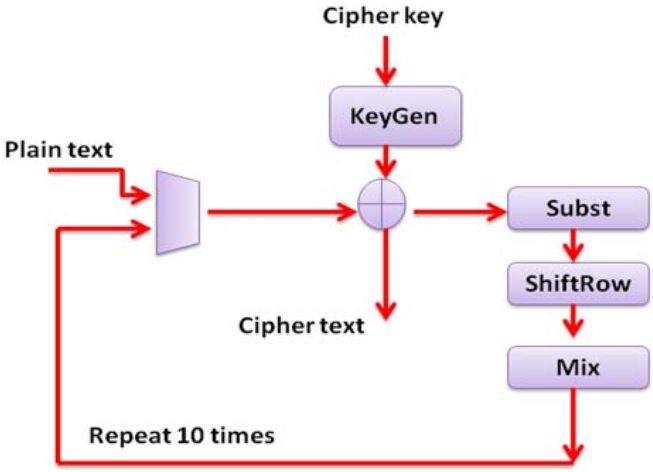

Figure 4: Basic architecture of AES algorithm

3. Implementation

Whenever sender sends video to the receiver, the video is mainly divided into frames (120 frames / sec). Computer is a digital electronic device which uses binary encoder. Hence, frames are converted into binary format i.e. 0100011000100. This is a 13 bit binary number. It takes bit of time to transmit 13 bit binary number. Open MPI and Open MP converts that binary bit to HEX string i.e. 0100 0110 0010. It is only 3 bit string. Now it is easy to transfer and require less time as compared to 13 bit. Open MPI first establishes connection between two computers and then start transferring the data, 'MPI_Comm_connect' function establishes connection with a server specified by port_name.

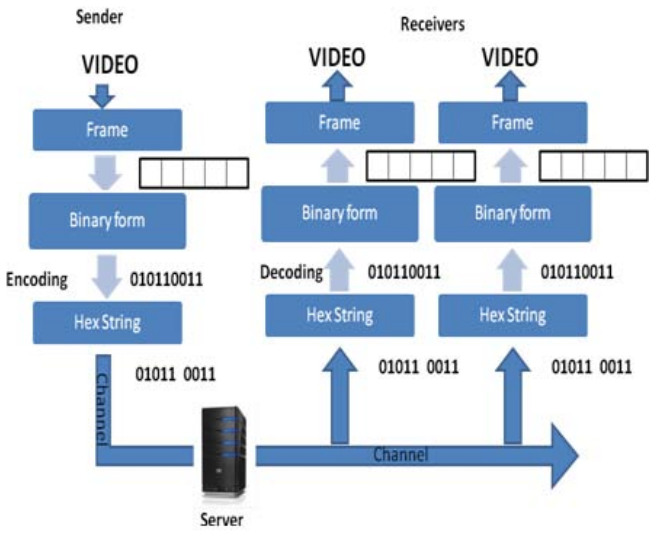

Figure 5: Flow diagram of implementation

'MPI_Comm_accept' allows communication with the receiver. Many programs are written with the master-slave model, where one process plays a supervisory role, and the other processes serve as compute nodes. In this framework, 'MPI_Comm_size' and 'MPI_Comm_rank' are useful for determining the roles of the various processes of a communicator. When connection establishes through server's channel, Open MP provide multiple threads. If the number of threads has not been explicitly set by the user, the default is implementation-defined by 'omp_get_num_threads'. In above figure two threads are created. So instead of sending video one by one Open MP sends it in parallel which gives fast transmission. At receiver's side Open MPI performs in exactly opposite manner. It converts HEX string to binary bit and then decoder decodes binary bit to frames which is nothing but a video.

The analysis result of proposed work is shown in fig 6. Fig6 (a) shows the video snapshot before applying Open MPI and Open MP, and fig6 (b) shows the video snapshot of after applying Open MPI and Open MP. The actual time of video is 0.0025 milliseconds. After applying Open MPI and MP it end at time 0.0028 milliseconds as compared to first one it take very less time.

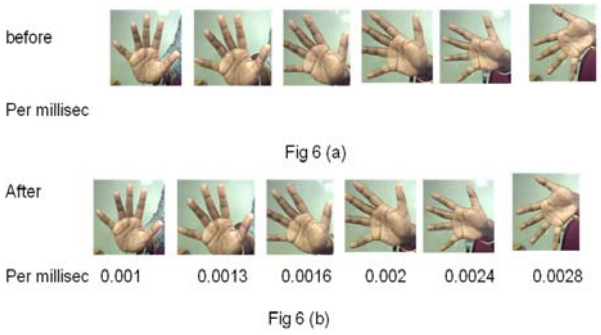

Figure 6: Analysis result of proposed work

4. Conclusion

The paper has discussed and introduced the new technique i.e. Open MPI and Open MP for parallel and distributed approach, by considering video conferencing as an application. The paper has discussed the Protocol TAPI and various Encryption methods available for real time video transmission. The new technique gives fast video transmission and secure from hackers by applying AES encryption algorithm.

References

[1] Wail S. Elkilani, Hatem M. Abdul-Kader Faculty of Computers and Information, Minufya University, IEEE 2009, pp 130-134
[2] Varalakshmi.L.M. Dr. Florence Sudha. G. Vijayalakshmi. V, Associate Professor/ Dept. of ECE. Proceedings of 2011 International Conference on Signal Processing, Communication, Computing and Networking Technologies (ICSCCN 2011)
[3] Alexander Wong and William Bishop Department of Electrical and Computer Engineering, University of Waterloo Waterloo, Ontario, Canada, 2005
[4] Jayshri Nehete, K. Bhagyalakshmi, M. B. Manjunath, Shashikant Chaudhari, T. R. Ramamohan Central Research Laboratory, 2005
[5] Jolly shah and Dr. Vikas Saxena IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 2, March 2011 ISSN (Online): 1694-0814 www.IJCSI.org
[6] ZHENG Ji-ming, GAO Wen-zheng. Color image encryption algorithmbased on chaotic map. Computer Engineering and Design, 2011, pp.2934-2937
[7] Jay M. Joshi, Kiran R. Parmar and Upena D. Dalal, "Design and Implementation of KASUMI Algorithm in ISMACryp Encryption for Video Content Protection in DVB-H Application", IEEE International Conference on Control, Robotics and Cybernetics (ICCRC 2011), vol 1, pp 18-21, March 2011.
[8] M. Abomhara, Omar Zakaria and Othman O. Khalifa, "An Overview of Video Encryption Techniques", IACSIT International Journal of Computer Theory and Engineering, Vol. 2, No. 1, pp 103-110, February, 2010.
[9] Fuwen Liu, Hartmut Koenig. "A survey of video encryption algorithms", Journal of Computers and Security, pp 3-15, 2010.
[10] Z. Shahid, M. Chaumont and W. Puech, "Fast Protection of H.264/AVC by Selective Encryption", WSPC – Proceedings: Singaporean-French IPAL Symposium, SinFra 2009, Fusionopolis, and September 2009.
[11] Ouni. T, Ayedi. W and Abid.M, "New low complexity OCT based video compression method", Proceedings of international Conference on Telecommunications, Marrakech, Morocco, pp.202-207, July, 2009.
[12] Shiguo Lian, Dimitris Kanellopoulos, and Giancarlo Ruffo, "Recent Advances in Multimedia Information System Security," International Journal of Computing and Informatics, Vol. 33, No.1, 2009, pp. 3-24.

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